

REMARKS

Applicant would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe the subject matter which applicant regards as the invention.

Claim 8 was objected to for improper antecedent basis in referring to "the primitive motion variable". Claim 8 has been amended to recite "a primitive motion variable". The amendment to claim 8 removes the Examiner's grounds for objection. Withdrawal of the objection is requested.

Claims 1, 3, 12, and 13 were rejected under 35 U.S.C. 102(b) as being anticipated by Alastair et al. (U.S. Patent No. 3,418,662). Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair. The rejections are traversed for the following reasons.

Initially, it is noted that an amendment to claim 1 has been tendered. Particularly, claim 1 has been amended to include the features of claim 6 and claim 6 has been cancelled. As claim 6 was not rejected as being anticipated by Alastair, the anticipation rejection of claim 1 has been circumvented. Similarly, claims 3 and 12, which depend from claim 1, are no longer anticipated by Alastair. The patentability of claims 1, 3, and 12 will be discussed herein based upon the obviousness rejection of claim 6.

In this regard, the invention defined in claim 1 is directed to an external force control method for controlling an external force applied to an animal through an orthosis attached to the animal that makes a movement along with the activities of

muscle fibers. The method includes a step of measuring a myoelectric potential that occurs in the body of the animal. Then, a value of an external force applied to the animal through the orthosis is set according to an external force function based on the measured value of the myoelectric potential. A motion variable is then measured, where the motion variable varies with the motion of the animal under the external force. The motion variable measuring step includes measuring the resultant force of an internal force and an external force of the animal as the motion variable. A value of a factor is then set according to a factor function based on the external force and the motion variable. The factor is set such that the ratio of the external force to the resultant force of the internal force and the external force is greater than or equal to zero and less than or equal to one.

The set value of the factor is then compared with a target value of the factor to determine if the deviation between the set value of the factor and the target value of the factor is less than a reference value. If the deviation is determined to be equal to or greater than the reference value, a new external force function is set such that the set value of the factor approaches the target.

The Examiner found the invention of claim 1 to be obvious based on the Alastair patent. To render claim 1 obvious, Alastair must teach or suggest each and every feature of the claim. It is asserted that Alastair fails to teach or suggest all features of claim 1 and that the obviousness rejection therefore lacks merit.

Initially, the Alastair control method teaches that EMG signals are obtained from the flexor and extensor muscles via input electrodes (1, 2) provided to the forearm of the agent. The movement of the artificial hand is controlled based on the EMG signals. Alastair, Col. 2, lines 18 – 64, Figs. 1 and 2.

In this regard, it is noted that the Alastair control method is not directed to a force that acts on the body of an agent. Rather, as summarized above, the Alastair control method translates the EMG signals into a movement of an artificial hand. Alastair is not directed to an orthosis that applies a force to the fingers of an agent based on the EMG signals of the flexor and extensor obtained at the forearm of the agent.

Therefore, Alastair fails to teach or suggest a control method "for controlling an external force applied to an animal through an orthosis attached to the animal that makes a movement along with the activities of muscle fibers", as required by claim 1. In this vein, Alastair also fails to teach or suggest "an external force setting step of setting a value of an external force f applied to the animal through the orthosis" and "an external force function setting step of setting a new external force function $f(x)$ ", as also required by claim 1.

For this reason alone, Alastair fails to teach or suggest all features recited in claim 1. Accordingly, Alastair fails to render claim 1 obvious.

Further, Alastair discloses that the operation of the motor (9) is controlled through the drive amplifier (10) when the deviation between the output of the summing junction (17) (i.e., the EMG minus the velocity feedback from the motor minus the force feedback from the strain gauge) is outside a set limit. Alastair, Col. 3, line 4 – Col. 4, line 24, Figs. 1 and 2. The Examiner presumably interprets this disclosure as teaching the determining step of claim 1. In so doing, the summing junction equation as a whole would correspond to the "external force function" of claim 1, where the force applied to the artificial hand corresponds to the "motion variable", the sum of the velocity feedback and the force applied to the artificial hand

correspond to the "factor", and the EMG corresponds to the "factor target value".

However, even if the summing junction were properly corresponded to the determining step of claim 1, it is noted that Alastair only teaches that the motor is driven by closing a switch when the magnitude of the deviation exceeds the set limit.

Alastair does not suggest switching the equation of the summing junction when the deviation exceeds the set limit.

Thus, Alastair fails to teach or suggest "an external force function setting step of setting a new external force function $f(x)$ in such a way that the set value of the factor γ approaches the target value γ_t if the deviation δ is determined to be equal to or greater than the reference value ε in the determination step", as required by claim 1. Particularly, Alastair does not teach or suggest a shift to a separate function (equation) for setting the external force when the deviation exceeds the set limit.

For this additional reason, Alastair fails to teach or suggest all features of claim 1. Accordingly, claim 1 is not rendered obvious by the Alastair patent.

Finally, with reference to the amendments made to claim 1, it is noted that the factor setting step now comprises setting the factor to a value equal to external force/(external force + internal force). As mentioned above, Alastair fails to account for the application of an internal force in setting an external force on the artificial hand. Therefore, Alastair fails to teach or suggest this further feature of claim 1.

For all of the above reasons, it is submitted that the Alastair patent fails to teach or suggest each and every one of the claim features recited in claim 1. Therefore, a *prima facie* case of obviousness has not been established to support the rejection of claim 1. Reconsideration and withdrawal of the rejection of claim 1 is requested. Claims 3 and 12 depend from claim 1 and are therefore likewise

considered allowable over the art.

With reference to claim 13, the invention defined therein is directed to an apparatus associated with the method defined in claim 1. Accordingly, the arguments presented above in favor of the patentability of claim 1 are considered relevant to claim 13. While the arguments will not be repeated, they are hereby incorporated in full.

As with claim 1, claim 13 recites features that are not taught or suggested by Alastair. Therefore, claim 13 is not rendered obvious by Alastair. Reconsideration and withdrawal of the rejection of claim 13 is requested.

Claims 2 and 5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair in view of Curcie et al. (U.S. Patent No. 6,660,042). The rejections are traversed for the following reasons.

Claims 2 and 5 depend from claim 1. Therefore, to render claims 2 and 5 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair patent have been discussed above.

The Curcie patent is cited for teaching a method for distributing forelimb forces in which each finger is assigned a coefficient or weight related to the external force. Further Curcie is cited for teaching a method in which there is a training mode in which the function variables are determined in a training step and then the mode is switched to a use mode in which the equation for each finger remains constant.

However, Curcie fails to remedy the shortcomings of Alastair in regards to claim 1. Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair and Curcie. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 2 and 5, based on their

dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 2 and 5 is requested.

Claim 4 was rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair in view of Haslam, II et al. (U.S. Patent No. 5,413,611). The rejection is traversed for the following reasons.

Claim 4 depends from claim 1. Therefore, to render claim 4 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair patent have been discussed above.

The Haslam patent is cited for teaching a force control method in which the external force is controlled in a way that the maximum measured force approaches the maximum target. However, Haslam fails to remedy the shortcomings of Alastair in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair and Haslam. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claim 4, based on its dependence from claim 1, is considered allowable over the art. Reconsideration and withdrawal of the rejections of claim 4 is requested.

Claims 7 and 8 were rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair in view of Kawai et al. (US 2004/0107780). The rejections are traversed for the following reasons.

Claims 7 and 8 depend from claim 1. Therefore, to render claims 7 and 8 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair patent have been discussed above.

The Kawai application is cited for teaching a an external force control method

in which primitive variables are measured and inputted to an inverse dynamics model along with motion state data in order to determine the motion state. However, Kawai fails to remedy the shortcomings of Alastair in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair and Curcie. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 7 and 8, based on their dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 7 and 8 is requested.

Claims 9 – 11 and 14 were rejected under 35 U.S.C. 103(a) as being unpatentable over Alastair in view of Davalli et al. (U.S. Patent No. 6,740,123). The rejections are traversed for the following reasons.

Claims 9 - 11 depend from claim 1. Therefore, to render claims 9 – 11 obvious, the combined references must teach or suggest all features of claim 1. In this regard, the shortcomings of the Alastair patent have been discussed above.

The Davalli patent is cited for teaching four band factors each depending from the bend of the wrist and EMG activity feedback which results in different force controls. However, Davali fails to remedy the shortcomings of Alastair in regards to claim 1.

Accordingly, claim 1 recites features that are not taught or suggested by the combination of Alastair and Davali. Therefore, claim 1 is not rendered obvious by the combined references. Consequently, claims 9 – 11, based on their dependence from claim 1, are considered allowable over the art. Reconsideration and withdrawal of the rejections of claims 9 – 11 is requested.

Claim 14 is directed to an external force control program for providing a

computer with functions for controlling an external force applied to an animal through an orthosis attached to the animal that makes a movement along with the activities of muscle fibers. Essentially, claim 14 is directed to a control program that instructs a computer to perform method steps similar to those recited in claim 1.

As the inventive method of claim 14 is similar to that of claim 1, the arguments presented above in favor of the patentability of claim 1 are considered relevant to the rejection of claim 14. Accordingly, while not repeated, the arguments are hereby incorporated in full. Therefore, as with claim 1, claim 14 recites features that are not taught or suggested by the Alastair patent. Further, as asserted above, Davali does not remedy the shortcomings of Alastair in regards to claim 14.

Consequently, claim 14 is not rendered obvious by the combined references. Reconsideration and withdrawal of the rejection of claim 14 is requested.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. SAT-16887.

Respectfully submitted,

RANKIN, HILL & CLARK LLP

By /Samir S.Khoury/
Samir S.Khoury, Reg. No. 60174

38210 Glenn Avenue
Willoughby, Ohio 44094-7808
(216) 566-9700